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Does presentation make a difference to risk perception: Testing different formats for communication of cancer risks

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Abstract

Evidence suggests that the presentation format of risk information can affect people's perceptions of risk and influence health-related decisions. In these studies we investigated the impact of four different risk presentation formats: standard presentation, risk ladder, different base rates and visual representations on women's perceptions of developing breast cancer of lymphoma. We found that the different presentations had virtually no impact on the participant's risk estimates. Only in the second study relating to risk perceptions for lymphoma was there a significant difference between conditions for estimated 10-year-risk, with those in the ladder present condition reporting a lower estimated risk. The implications of these findings for future research on consumer risk perceptions are discussed.

Keywords

difference, presentation, risk, make, perception, does, testing, different, formats, communication, cancer, risks

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Contributions, Controversies, and Continuing Challenges in the Worlds of Consumer Protection and Competition

EDITORS Elizabeth S. Moore Janis K. Pappalardo William L. Wilkie

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PREFACE

The year 2009 marked the twentieth anniversary of the Marketing and Public Policy Conference (MPPC). It was celebrated on May 28–30 in the historic Madison Hotel in Washington, DC, with the theme "Contributions, Controversies, and Continuing Challenges in the Worlds of Consumer Protection and Competition." Continuing to build on the fine tradition established by previous conferences, the 2009 conference was likely the largest conference in the twenty-year history, with 153 presentations scheduled over a wide variety of interesting, timely, and important topics. This conference is the premier event for marketing scholars and practitioners interested in topics related to social and public policy. It brings together an international roster of academics, marketing practitioners, government officials, consumer representatives, legal professionals, business representatives, and other interested parties to discuss current issues and research results pertaining to significant public policy issues in marketing.

This year the MPPC was also preceded by a one-day Emerging Scholars Research Consortium with the theme "Stepping Forward with Marketing in Society Research." Sessions here covered (1) the six subfields within marketing in society research, (2) key elements of fine research in this area, (3) presentations by editors of the key journals, (4) the work of public policy researchers in government and think tanks, and (5) identification of significant emerging issues in need of much future attention. Some 80 distinguished faculty fellows, doctoral students, and junior faculty members interested in working in this field convened for this event, which was sponsored by the University of Notre Dame and the Association for Consumer Research.

The matching of the MPPC planners from Notre Dame and the FTC in 2009 was especially fitting, as the conference itself had begun in 1989 at the University of Notre Dame, with an invitation-only symposium assembled to study the future of the FTC's operations. The conference then returned to Notre Dame for its tenth anniversary, and now it has convened in Washington, DC, with a series of special "20th Anniversary Sessions" to examine what has changed during that time, what is changing now, and what will change in the future, featuring experts from government, business, and not-for-profit organizations joining academics in addressing these issues. For example:

- Given the conference's history, it was fitting that the first 20th Anniversary session was "A Two Decade Perspective on Changing FTC Priorities, Initiatives, and Impact." Here, three former directors of the FTC's Bureau of Consumer Protection and a longtime chief regulator in advertising and consumer protection discussed and debated past developments and future directions.
- The next 20th Anniversary session, "Exploring the Mortgage Crisis: Causes and Remedies," featured experts who described how the situation developed, and they debated the preferred approaches for dealing with it.
- This was followed by the 20th Anniversary session, "Behavioral Targeting by Marketers: Boom or Doom?" In this session, leaders of the consumer movement and key speakers from the FTC, industry, and academia explored the ramifications of emerging marketing methods on the Internet and the questions they raise about consumer privacy.
- Next was "15 Years Since NLEA Regulations: Emerging Issues, New Variables, and How Nutrition Labeling Really Works," which presented a series of findings from government research on food information disclosures.
- In the last of the 20th Anniversary sessions, "JPP&M's History and Contributions: Reflections of Its Editors," the history of this important journal was explicated and assessed by a panel of all its editors.

We discuss these separately here because only brief abstracts of the 20th Anniversary sessions appear in this volume. However, the core of the conference is well displayed herein. This featured a wide array of special sessions, competitive papers, and working papers on exciting current topics, including sustainability, consumer credit, and financial services, as well as health-related topics, such as health literacy, obesity, information disclosures, and new forms of health service provisions. For additional, rich panoply of thought represented herein, see the Table of Contents.

Several organizations and individuals generously contributed their time and financial resources to help make the 2009 MPPC a success. First, we thank the Marketing Science Institute, the Association for Consumer Research, and the Mendoza College of Business at the University of Notre Dame for their generous financial support of the conference and consortium. Special thanks also go to the planning committee members and reviewers for their thoughtful inputs in the planning process and for their participation in the conference itself. We also thank Jessica Bannister, Cher Dougherty, Francesca Cooley, and Marie Steinhoff of the American Marketing Association for their assistance in conference planning and publication of the conference proceedings. We greatly appreciate the very capable administrative assistance of Elizabeth Pike, ND '09, who handled a multitude of tasks with skill, insight, and enthusiasm. Thanks also go to our colleagues at Notre Dame and the FTC, particularly John Sherry, Dean Carolyn Woo, Debbie Desrochers, and Pauline Ippolito for their support and encouragement. It was our sincere pleasure to organize this conference, and we greatly appreciate the efforts of all who participated.

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DOES PRESENTATION MAKE A DIFFERENCE TO RISK PERCEPTION: TESTING DIFFERENT FORMATS FOR COMMUNICATION OF CANCER RISKS

Sandra C. Jones, University of Wollongong, Australia

ABSTRACT

Evidence suggests that the presentation format of risk information can affect people's perceptions of risk and influence health-related decisions. In these studies we investigated the impact of four different risk presentation formats: standard presentation, risk ladder, different base rates and visual representations on women's perceptions of developing breast cancer or lymphoma. We found that the different presentations had virtually no impact on the participant's risk estimates. Only in the second study relating to risk perceptions for lymphoma was there a significant difference between conditions for estimated 10-year risk, with those in the ladder present condition reporting a lower estimated risk. The implications of these findings for future research on consumer risk perceptions are discussed.

INTRODUCTION

It has been consistently shown that women tend to overestimate their own risk of developing breast cancer (e.g., Black, Nease, and Tosteson 1995; Smith et al. 1996), and the population incidence of breast cancer (e.g., Barratt et al. 1997). It has been argued that this overestimation is due in large part to the sensationalist and misleading coverage of breast cancer in the mainstream media (NHMRC National Breast Cancer Centre 1999; Jones 2004; Blanchard et al. 2002). There is considerable evidence that risk estimations, and processing of risk information, are influenced by the extent to which specific risks are "available," in people's minds; for example, that people are exposed to via media coverage or personal experience (e.g., Kuran and Sunstein 1999).

Presenting Risk Information

Attitude theory assumes that the mode of presentation of attributes should not matter, as long as the same information is presented (e.g., McGuire 1985; Petty and Cacioppo 1986). Behavioral Decision Theory (BDT), on the other hand, posits that task characteristics (such as the mode of presentation format and response format) can have considerable impact on the evaluation of outcomes, and thus on intentions and behavior (e.g., Cox and Grether 1994; Hoeffler and Ariely 1999; Simonson et al. 2001). Traditional theories of decision-making, such as the theory of rational choice (Savage 1954; vonNeuman and Morgenstein 1947), assume that people make choices that maximize their well-being or utility in a given situation, within available resources and constraints. That is, people are assumed to be rational and to make rational choices using common knowledge. The foundation of theories of rational choice is invariance (Slovic 1995); that is, rational choices must comply with the assumptions of: (a) *description invariance* – preferences should not depend on the description of options; and (b) *procedure invariance* – preferences should not depend on the method of elicitation.

However, empirical investigations of decision-making have shown many violations of both description invariance and procedure invariance. The application of this research to health-behavior has been limited to a few studies, although there is a large body of research on message framing, i.e., presenting logically equivalent in semantically different ways (Krishnamurthy, Carter, and Blair 2001). Studies of framing effects on health-related intentions and behavior have been conducted in numerous areas, including breast self-examination (Lalor and Hailey 1990; Meyerowitz and Chaiken 1987) and mammography (Banks et al. 1995). Within this paradigm, researchers have also considered the effects on risk perceptions of interactions between framing and other variables, such as source credibility (Grewal, Gotlieb, and Marmorstein 1994).

While there are a limited number of studies focusing specifically on message presentations effects in health behavior communications, the evidence from the existing studies suggests that the presentation format of risk information can affect people's perceptions of risk and influence health-related decisions, including decisions about whether to accept medical treatment (e.g., Kaplan et al. 1985; Feldman-Stewart et al. 2000). However, studies of particular formats (such as "risk ladders" or "1 in x" scales) are limited in number and have produced inconsistent findings, with evidence for the superiority of a presentation format in one study being absent or reversed in another.

The purpose of the present study was to investigate the effect of four different format manipulations on women's perceptions of their risk of developing breast cancer. First, a brief overview of the literature on women's perceptions of breast cancer risk is provided, followed by a review of previous studies of the four risk format manipulations that were the focus of the current research. An experimental study was conducted to investigate these manipulations – this study is described and the findings presented and discussed. Due to the unexpected nature of these findings, a second experimental study was conducted using a different cancer type and this second study is described and the findings presented and discussed. Finally, the implications of the two studies are examined.

Risk Communication Formats

It has been suggested that some of the differences in proportions of women over-estimating their risk of breast cancer – e.g., approximately one-third of U.K. women compared to two-thirds of U.S. women – may be due to differential exposure to risk information (Hopwood 2000), both in terms of the amount of exposure and the accuracy and nature of such information. There are few studies that have actually compared the effectiveness of different risk information presentation formats, and most have only varied one aspect of the information. Further, as discussed above, the results of these studies are frequently conflicting or inconsistent (Vernon 1999). The following section reviews the four information presentation features to be investigated in the current studies.

Natural Frequencies (1 in X). Gigerenzer and Hoffrage (1995) provided two groups of participants with hypothetical information about breast cancer incidence and mammography diagnostics and found that almost three times as many of the participants given the information in natural frequency format were able to provide the correct answer (46% correct compared to 16%). Similar effects have been demonstrated for communicating information about the accuracy of mammograms to laypeople (Hoffrage 2003). Based on this and several other studies, Hanoch and Pachur (2004) have advocated that nurses use natural frequencies to communicate statistical information to patients. The "standard" breast cancer message in Australia is "1 in 8 Australian women will develop breast cancer." Based on the research on the use of natural frequencies, we propose:

H1: The use of the "standard presentation" (1 in X) format will lead to more accurate (i.e., lower) estimates of breast cancer risk.

Risk Ladder. The use of a risk ladder (i.e., presenting the risk of a disease or condition in the context of other, known, diseases) provides people with a context in which to evaluate the risk, and thus should lead to more accurate risk perceptions. Loomis and duVair (1993) found that a risk ladder was more effective in conveying information about a risk in comparison to other risks. The use of risk ladder presentations of risk information is common in lay publications. For example, *USA Today* has used risk ladders to communicate the likelihood of being murdered with a gun, compared to the likelihood of dying from a range of other non-natural causes (Memmott 2002). It is reasonable to assume that presenting a risk in the context of other known risks (with which people are likely to have first- or second-hand experience) should increase the accuracy of risk perceptions (particularly relative to other risks). Thus:

H2: The inclusion of a risk ladder will lead to more accurate estimates of breast cancer risk

H3: The inclusion of a risk ladder will lead to more accurate estimates of breast cancer risk in relation to other risks which are included on the risk ladder

Different Base Rates. A commonly manipulated variable in the presentation of risk information is the size of the denominator (base rate). That is, a risk can be presented in terms of the incidence per 10, 100, 1,000 or any other number of people, and the numerators will be progressively larger (for example, "one in ten" can be presented as "100 in 1,000"). Several studies have demonstrated that people tend to display "base-rate neglect," which is to focus on the numerator and ignore the denominator. One study (Yamagishi 1997) found that 1,286/10,000 was assessed as a greater risk than 24.14/100. That is, people tended to focus on the total number of affected people (1,286 compared with 24.14) rather than the proportion (12.86% compared with 24.14%). The existence of base-rate neglect means that a larger base will result in higher estimates of breast cancer risk. Given that, in general, women overestimate their risk of breast cancer, it is reasonable to assume that the use of a lower base will result in more accurate (i.e., lower) risk perceptions. Thus:

H4: The use of a smaller base (100) will result in more accurate (i.e., lower) estimates of breast cancer risk than the use of a larger base (1,000).

Visual Representation. It is generally believed that visual information communicates more effectively than verbal information ("a picture is worth a thousand words"); and

that the most effective communication combines the two forms. This strategy is used in the media to convey comparative statistical information; for example, USA Today used gender symbols (each representing 10 individuals) to demonstrate the small number of women who are executed relative to men (Ahrens 2002). Graphic presentation of information has been found to assist in people's processing of numerical information (Cleveland and McGill 1984). However, risk information is generally presented in numerical form (i.e., percentage, proportion, risk ratio etc.) or verbal-numerical (i.e., using verbal descriptors of probability such as "often" or "rarely"). Kaplan et al. (1985) found that using graphical displays to present extremely small probabilities of side effects increased participants' willingness to take a hypothetical vaccine; suggesting the tendency to overemphasize small probabilities may be reduced by a visual illustration of how small they really are. However, Schapira and colleagues (2001) found that the use of human-like visual representations increases perceived risk, perhaps due to the increased salience and "personalization" of the information. It appears logical, given the processing differences discussed above, that the addition of visual information would result in higher perceptions of risk.[1] Thus:

H5: The addition of visual representation of risk to verbal information will lead to less accurate (i.e., higher) estimates of breast cancer risk.

STUDY 1

The purpose of this study was to investigate the effect of manipulating the four information presentation variables discussed above on women's estimates of their own absolute and comparative risk of developing breast cancer.

Methodology

Participants. The study participants were 182 women aged 18–81 years (mean = 43.5 years). Quotas were established to ensure even representation of participants across three pre-determined age groupings: < 35 years, 35–49 years, and 50 years and over – with the final proportions in the three groups being 34.6 percent (63), 33 percent (60), and 32.4 percent (59) respectively. Ninety-eight percent of the participants had completed some high school, with 86.7 percent having completed at least 10 years of education (i.e., three years of secondary), 60.8 percent at least 12 years (high school graduates), and 51.9 percent a post-secondary qualification. All of the participants were fluent in English, with 98 percent speaking English at home. Current or previous breast cancer was an exclusion criterion for this study. Required sample size was determined based on the results of the Lipkus et al. (2000) study, and the estimation of a meaningful effect size.

Stimuli. As shown in Table 1, there were nine conditions in the study (that is, women were randomly allocated to reading one of nine versions of the information sheet).

All versions included the same basic information on breast cancer incidence and risk factors, and a photograph of Sara Henderson (an Australian celebrity who is the spokesperson for the national breast cancer screening campaign).

Estimated Risk. Participants were asked to estimate their risk of developing breast cancer (a) in the next 10 years and (b) in their lifetime on a 0–100 scale, where 0 = "No chance of me getting breast cancer" and 100 = "I will definitely get breast cancer." They were then asked to estimate their risk (c) compared to their risk of developing heart disease and (d) compared to other women their age on a five-point scale, where 1 = a lot higher, 3 = about the same, and 5 = a lot lower.

Exposure to Breast Cancer. Participants were asked whether any of their family members or friends had ever had breast cancer. Response options were "None that I know of," "1 (family member/friend)," "2–3 (family members/friends)," and "more than 3 (family members/friends)."

Health Literacy and Numeracy. Health literacy was measured with a subset of items from the S-TOFHLA (Baker et al. 1999); the S-TOFHLA and the longer TOFHLA are the recommended instruments for measuring functional health literacy (Ad Hoc Committee on Health Literacy for the Council on Scientific Affairs 1999). Health numeracy was measured using the scale developed by Lipkus, Samsa, and Rimer (2001).

Results

Previous Exposure to Breast Cancer. Sixty-nine percent (125) of the respondents reported that they had no family members with breast cancer, 23 percent (41) had one family member with breast cancer, and 8 percent (15) two or more family members. Forty-four percent (79) of the respondents reported that they had no friends with breast cancer, 26 percent (47) had one friend with breast cancer, and 30 percent (54) two or more friends.

Health Literacy and Numeracy. The mean health literacy score was 5.2 (SD = 1.8), within a possible range of zero to seven. For example, 86 percent correctly interpreted a

TABLE 1
The Nine Information Conditions

	Standard Risk Format	Base Rate 100	Base Rate 1,000
Risk ladder present	1	2	3
Visual present	4	5	6
Ladder & visual absent	7	8	9

prescription label that stated "finish all this medication" to mean that they should take all of the tablets. The mean numeracy score was 5.1 (SD = 1.8), within a possible range of zero to seven. Across each of the seven items, there were similar proportions of correct responses to the Lipkus, Samsa, and Rimer (2001) study.

Estimated Risk (All Participants). The mean response to the question "How likely is it that you will get breast cancer *in the next 10 years*?" was 30.4 percent (sd = 22.8). Whilst this value is considerably higher than the objective mean risk for this population – less than 2 percent for the group as a whole, given the mean age of the participants[2] (Merrill et al. 1999) – it is remarkably consistent with results from similar studies. For example, using the same 0 to 100 scale, Lipkus et al. (2000) found a mean estimate of 30.2 percent (sd = 21.7) for perceived risk of breast cancer in the next 10 years.

The mean response to the question "How likely is it that you will get breast cancer *in your lifetime*?" was 35.1 percent (sd = 22.5). As for the 10-year risk estimate, this value is higher than the objective risk – interestingly, it is only fractionally higher than perceived 10-year risk – but is again consistent with previous findings. The mean estimate of the lifetime risk in the Lipkus et al. (2000) study was 34.4 percent (sd = 22.3).

It is apparent from a comparison of the responses to the two questions that a majority of women demonstrate difficulty in distinguishing between 10-year and lifetime risk, or at least in articulating this distinction. Only 33.7 percent (61) of the respondents correctly provided a lifetime risk estimate higher than their 10-year risk estimate; 57.5 percent (104) provided equal estimates for the two risks (which would only be accurate if they had exactly 10 years left to live); and 8.8 percent (19) gave a lifetime risk estimate lower than their 10-year risk estimate. Again, these findings are remarkably consistent with Lipkus et al. (2000) who reported corresponding figures of 32 percent, 61 percent, and 7 percent.

The mean response to the question "Compared to your chance of developing heart disease, do you think your chance of developing breast cancer is . . ." was 2.9 (sd = 1.2) on a five-point scale (where 1 = a lot higher, 3 = about the same, and 5 = a lot lower). That is, on average, the women rated their risk of developing breast cancer to be approximately equivalent to their risk of developing heart disease – when, in fact, their average risk of developing heart disease is four times higher than their risk of developing breast cancer.

The mean response to the question "Compared to other women your age, do you think your chance of developing breast cancer is . . ." was 2.8 (sd = 0.8) on the same scale as the previous question. That is, on average, the women rated their risk of developing breast cancer as marginally higher than other women their age.

Effect of Presentation Manipulations

Effect of Standard Presentation. There were no significant differences in risk estimates between those participants in the standard presentation and other presentation conditions, for any of the four dependent variables. The mean 10-year risk estimate was 0.4 percent lower for those in the standard presentation condition (CI = -7.5% to 6.6%); the mean lifetime risk estimate was 0.1 percent higher (CI = -6.8% to 7.1%). The mean difference in relative risk scores was less than 0.1 on a 5-point scale for both risk compared to heart disease (0.05, CI = -0.3 to 0.4) and risk compared to other women (-0.02, CI = -0.3 to 0.2). Thus, H1 was not supported.

Effect of Risk Ladder. There were no significant differences in risk estimates between those participants in the risk ladder present and risk ladder absent conditions, for any of the four dependent variables. The mean 10-year risk estimate was 1.0 percent higher for those in the risk ladder condition (CI = -6.2% to 8.1%); the mean lifetime risk estimate was 2.0 percent higher (CI = -5.0% to 9.0%). The mean difference in relative risk compared to other

women was – 0.1 on a 5-point scale (CI = -0.3 to 0.2). Thus, H2 was not supported. Further, the mean difference in relative risk compared to heart disease (which was clearly shown on the ladder to be four times the risk of breast cancer) was -0.1 on a 5-point scale for risk (CI = -0.5 to 0.3). Thus, H3 was not supported.

Effect of Different Base Rates. There were no significant differences in risk estimates between those participants in the base 100 and base 1,000 conditions, for any of the four dependent variables. The mean 10-year risk estimate was 1.0 percent higher for those in the base rate 100 condition compared to those in the base rate 1,000 (CI = -7.5% to 9.5%); the mean lifetime risk estimate was 4.2 percent higher (CI = -4.0% to 12.4%). The mean difference in relative risk scores was -0.01 on a 5-point scale for risk compared to heart disease (CI = -0.5 to 0.4) and 0.2 for risk compared to other women (CI = -0.1 to 0.5). Thus, H4 was not supported.

Effect of Visual Representation. There were no significant differences in risk estimates between those participants in the visual representation present and visual representation absent conditions, for any of the four dependent variables. The mean 10-year risk estimate was 2.7 percent lower for those in the visual representation condition (CI = -9.8% to 4.5%); the mean lifetime risk estimate was 1.1 percent lower (CI = -8.1% to 5.9%). The mean difference in relative risk scores was -0.1 on a 5-point scale for risk compared to heart disease (CI = -0.5 to 0.3) and -0.1 for risk compared to other women (CI = -0.4 to 0.2). Thus, H5 was not supported.

Predictors of Risk Estimates

There were only two significant predictors of perceived 10-year risk of developing breast cancer: having a family member with breast cancer resulted in a higher risk estimate ($t = 3.8$, $p = .000$); and having a low numeracy score ($t = 2.3$, $p = .02$). In total, the model predicted 13 percent of the variance in risk estimates ($p = .002$). None of the other variables entered into the model (presentation format, friend had breast cancer, age, language spoken at home, education level, and literacy score) were significant predictors of estimated 10-year risk.

There was only one significant predictor of perceived lifetime risk: having a family member with breast cancer again resulted in a higher risk estimate ($t = 4.1$, $p = .000$). This final model predicted 11 percent of the variance in risk estimates, and again none of the other variables were significant predictors.

Having a family member with breast cancer was also the only significant predictor of perceived comparative risk – that is, risk compared to women of the same age ($t = 3.7$, $p = .000$), and compared to risk of developing heart disease ($t = 2.4$, $p = .02$).

Discussion

Contrary to all of the hypotheses, risk information presentation format was found to have *no impact* on perceived risk. This is an important finding, particularly in the context of inconclusive and contradictory results from previous studies. While the sample sizes were relatively small, there was sufficient power to detect meaningful differences, thus small sample size is not sufficient to explain the lack of significant differences for any of the presentation formats. The confidence intervals were consistently narrow enough to allow us to conclude that there were no meaningful differences in risk estimates between the conditions.

It was very clear from this study that the primary predictor of perceived breast cancer risk is having had a family member with breast cancer. Previous studies have found that women's perceptions of their own breast cancer risk are strongly influenced by family history. For example, a study of perceived risk among employees in an oncology Centre (Helzlsouer et al. 1994) found that perceived risk of breast cancer was approximately double among women with a first-degree relative with breast cancer for both 20-year risk (63% versus 29%, $p < .005$) and 40-year risk (73% versus 40%, $p < .005$). Further, perceived risk was considerably higher among women who had both a friend and a relative (any relation) with breast cancer (40-year risk 51% versus 29%, $p < .001$).

One possible explanation for the unexpected absence of presentation effects is that, due to women's exposure to a wide range of information on breast cancer risk, the participants had already established estimates of their own risk and thus were not influenced by the information presented to them. In order to exclude this explanation, a second study was conducted using information about the risks of developing a cancer to which participants would have had little, if any, exposure.

STUDY 2

Study 2 was designed to exactly replicate Study 1 in terms of methodology and risk presentation formats. However, the context chosen was the risk of developing lymphoma (we did not specify whether Hodgkins or non-Hodgkins).

This cancer was chosen following a pre-test with 20 women in the target age group, which confirmed that they had minimal knowledge of lymphoma, and no pre-existing personal risk estimates.

The hypotheses were the same as those in study 1.

Methodology

Participants. The study participants were 99 women aged 18–82 years (mean = 38.3 years). Quotas were again established to ensure even representation of participants across three pre-determined age groupings, although in this study there was a smaller than expected proportion in the oldest group: < 35 years, 35–49 years, and 50 years and over – with the proportions in the three groups being 44.9 percent (44), 35.7 percent (35), and 19.4 percent (19) respectively. Ninety-six percent of the participants had completed some high school, with 83.7 percent having completed at least 10 years of education (i.e., three years of secondary), with 61.2 percent at least 12 years, and 41.8 percent a post-secondary qualification. All of the participants were fluent in English, with 97 percent speaking English at home. Current or previous lymphoma was an exclusion criterion for this study.

Stimuli. As for study 1, there were nine conditions in the study (that is, women were randomly allocated to reading one of nine versions of the information sheet). All versions included the same basic information on lymphoma incidence and risk factors; what was varied was: the numerical presentation of the risk (i.e., "one in 92," "one out of 100" or "10 out of 1,000"); the inclusion or exclusion of the risk ladder; and the inclusion or exclusion of visual representation.

Measures

Estimated risk. Participants were asked to estimate their risk of developing lymphoma (a) in the next 10 years and (b) in their lifetime on a 0–100 scale, where 0 = "No chance of me getting lymphoma" and 100 = "I will definitely get lymphoma." They were then asked to estimate their risk (c) compared to their risk of developing heart disease and (d) compared to other women their age on a five-point scale, where 1 = a lot higher, 3 = about the same, and 5 = a lot lower.

Exposure to Lymphoma. Participants were asked whether any of their family members or friends had ever had lymphoma. Response options were "None that I know of," "1 (family member/friend)," "2–3 (family members/friends)," and "more than 3 (family members/friends)."

Health Literacy and Numeracy. Health literacy was measured with the same subset of seven items from the S-TOFHLA (Baker et al. 1999). Numeracy was measured using the same seven-item numeracy scale developed by Lipkus et al. (2001).

Results

Previous Exposure to Lymphoma. The majority of the respondents (86%) reported that they had no family members with lymphoma, 11 percent (11) had one family member with lymphoma, and 3 percent (3) two or more family members. Similarly, 76 percent (75) of the respondents reported that they had no friends with lymphoma, 16 percent (16) had one friend with lymphoma, and 8 percent (8) two or more friends.

Health Literacy and Numeracy. The mean health literacy score was 5.6 (SD = 1.8), within a possible range of zero to seven. That is, the mean health literacy score for this group was marginally higher than for the Study 1 participants, and again consistent with previous studies. The mean numeracy score was 5.1 (SD = 1.9), within a possible range of zero to seven. That is, the mean numeracy score for this group was the same as the mean score of the Study 1 participants.

Estimated Risk (All Participants). The mean response to the question "How likely is it that you will get lymphoma in the next 10 years?" was 20.5 percent (SD = 21.2). While this value is considerably lower than the mean estimated risk for breast cancer, it is much higher than the objective mean risk for this population (4%).

The mean response to the question "How likely is it that you will get lymphoma in your lifetime?" was 26.2 percent (SD = 23.4). As for study 1 (breast cancer), the lifetime risk estimate is not a lot higher than perceived 10-year risk.

The mean response to the question "Compared to your chance of developing heart disease, do you think your chance of developing lymphoma is . . ." was 2.4 (SD = 1.1) on a five-point scale (where 1 = a lot lower, 3 = about the same, and 5 = a lot higher). That is, on average, the women rated their risk of developing lymphoma to be slightly lower than their risk of developing heart disease – when, in fact, their average risk of developing heart disease is approximately 30 times higher than their risk of developing lymphoma.

The mean response to the question "Compared to other women your age, do you think your chance of developing

lymphoma is . . ." was 2.6 (SD = 0.9), on the same scale as the previous question. That is, on average, the women rated their risk of developing lymphoma as marginally lower than other women their age.

Effect of Presentation Manipulations

Effect of Standard Presentation. As for Study 1, there were no significant differences in risk estimates between those participants in the standard presentation and other presentation conditions, for any of the four dependent variables. Thus, H1 was not supported.

Effect of Risk Ladder. As for Study 1, there were no significant differences in risk estimates between those participants in the risk ladder present and risk ladder absent conditions for lifetime risk or risk compared to other women. There was, however, a significant difference between conditions for estimated 10-year risk, with those in the ladder present condition reporting a lower estimated risk (15.9% versus 26.1%; a difference of 6.8%, CI = -15.9 to 2.2; t = 2.1; p = .04). Thus, H2 was partially supported. Further, the mean difference in relative risk compared to heart disease (which was clearly shown on the ladder to be many times the risk of breast cancer) was -0.3 on a 5-point scale for risk (CI = -0.8 to 0.2). Thus, H3 was not supported.

Effect of Different Base Rates. As for Study 1, there were no significant differences in risk estimates between those participants in the base 100 and base rate 1000 conditions, for any of the four dependent variables. Thus, H4 was not supported.

Effect of Visual Representation. As for Study 1, there were no significant differences in risk estimates between those participants in the visual representation present and visual representation absent conditions, for any of the four dependent variables. Thus, H5 was not supported.

Predictors of Risk Estimates

There was only one significant predictor of perceived risk of developing lymphoma: having a family member with lymphoma. Those with a family member with lymphoma provided significantly higher 10-year risk estimates (t = 3.3, p = .002) and lifetime risk estimates (t = 3.5, p = .001). Having a family member with lymphoma was also the only significant predictor of perceived comparative risk – that is, risk compared to women of the same age (t = 3.3, p = .001) and compared to risk of developing heart disease (t = 1.9, p = .05).

Discussion

The results of Study 2 are remarkably consistent with those of Study 1, in the virtual absence of any effect of risk information presentation variables on participants' estimates of own risk. Although the sample sizes were smaller than for Study 1, the confidence intervals were again consistently narrow enough to allow us to conclude that there were no meaningful differences in risk estimates between the conditions. Thus, the lack of effects on risk perceptions of the different presentation formats cannot be attributed solely to small sample sizes. The only effect detected in this study was a shift toward more accurate estimates with the presence of a risk ladder, although this effect was only found for 10-year risk estimates, not for lifetime or comparative risk estimates; a counter-intuitive result as it would be expected that the presence or absence of a clear statement of the relative position of lymphoma risk compared to heart disease risk would increase the accuracy of responses to the specific "compared to your risk of heart disease . . ." question.

CONCLUSIONS

Both Study 1 and Study 2 found that the inclusion of presentation elements posited to reduce overestimations of risk, such as risk ladders, and those posited to increase overestimations, such as visual representation, had no impact on participants' estimated risk of developing breast cancer or lymphoma. Across the two studies, only one significant effect was noted; given that a total of 32 comparisons were made, and we used the criterion of a .05 level of significance, it is not unexpected that we would find at least one apparently significant difference purely by chance.

It was suggested that the reason for the absence of effects in Study 1 may have been due to participant's awareness and exposure to high levels of media coverage relating to breast cancer, and thus predetermined perceptions of risk. Thus Study 2 focused on lymphoma, a far less well-known cancer and one which the majority of participants had no personal experience. However, with one minor exception, the absence of effects of presentation elements on risk perceptions remained.

Both Study 1 and Study 2 found that the women reported risk estimates for 10-year and lifetime risk that were considerably higher than their actual mean risk, contrary to the principle of defensive optimism (where people perceive their own chances of negative consequences to be lower than those of other people) which appears to

apply to a wide range of negative health events. Although their risk estimates were not as high for lymphoma (Study 2) as for breast cancer (Study 1), the actual risk of lymphoma is much lower than that of breast cancer – thus the degree of overestimation is similar.

These findings appear to be in conflict with much of what has been found in previous consumer research, particularly in the area of behavioral decision theory, which suggests that presentation format should have an impact on risk perceptions. The current study's results have three important implications for future consumer research. First and foremost, we need to examine the extent to which findings in consumer research are generalizable across topic areas, particularly in terms of the impact of consumer's preconceived estimates of disease risk and the extent to which these are resistant to change in the face of accurate statistical information. For example, previous studies have demonstrated that women's inaccurate breast cancer risk perceptions often remain even after personalized genetic counseling (Hopwood 2000). It is estimated that the average woman's risk of developing heart disease is approximately 32 percent (Lloyd-Jones et al. 1999); that is, three times her risk of developing breast cancer (Blanchard et al. 2002). However, several studies have shown that women are more concerned about developing breast cancer than developing heart disease (Blanchard et al. 2002).

Future studies should consider the impact of health literacy and numeracy, as well as the impact of prior exposure to medical conditions or information about these conditions. It is also essential to undertake further examination of the effects of different risk information presentation formats on perceived risk. Further studies are needed to determine which formats have the greatest impact on risk perception; and which have no, or minimal, impact. Ideally, this should include a meta-analysis of all previous findings – including null findings (many of which are likely to be unpublished studies) – to determine the extent to which current beliefs about the effects of different formats are actually supported by the research evidence.

Finally, as pointed out by Fischoff et al.(1998), it is important to bear in mind that consumer's risk decisions are extremely complex: they are not just "waiting for a missing number – upon receipt of which they will run the calculations needed to identify the best course of action" (p. 669). Thus, any research evidence on the effects of different formats needs to be considered – and, ideally, conducted – in the context of consumer's understanding of the issues, information needs, beliefs and values, and other influences in their environment.

ENDNOTES

1 As the risk of breast cancer, unlike the hypothetical vaccine in the Kaplan (1985) study, is not a very small risk.

2 Ranging from 1.5 percent for a 40 year old woman to 10.7 percent for a 70 year old.

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